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Venting device, particularly for fluid-storing reservoirs such as tanks

The invention relates to a venting device, particularly for fluid-storing reservoirs such as tanks, with a connecting part for establishing an air-carrying or fluid-carrying connection to the interior of the reservoir, and with a closure part which can be removed from the connecting part, especially in the form of a sealing cap, there being at least one leakage point in the manner of an air exchange opening when the closure part has been fitted between it and the connecting part.

These tank venting devices, which are generally provided with filters, prevent environmental contamination from being able to penetrate into the hydraulic system, beginning with the tank, in spite of air exchange. Improperly designed tank venting can lead to serious additional burdening of the filter circuit and thus to a shortened service life of the filter elements, so that the performance values of the venting device must be adapted to the system filter in the hydrosystem. In particular, tank venting devices with their filters are designed for efficient precipitation of solid particles from the air flowing subsequently into the tank.

Furthermore, it has been found that in practical use of the venting devices, tank and/or engine contamination is generally effected with steam jet devices under high pressure, with the result that penetrating media such as water and/or detergent chemicals may enter the interior of the venting device and moreover the tank interior by way of leakage points between the sealing cap (closure part) and the connecting part by way of which the venting device can be placed on the tank and can be connected to it; this is exceptionally disadvantageous for the quality of the stored fluid in the tank, especially when contamination parts are thus flushed in at the same time by way of the fluid. The pertinent tank venting devices with and without filters are known in a plurality of embodiments and are readily available commercially. The pertinent devices can also be additionally equipped with filling strainers, so-called spin-on cartridges, air driers, adapter pieces, etc.

On the basis of the state of the art described in the foregoing, the object of the invention is to further improve the known venting devices such that any leakage points within the venting device are reliably sealed against penetrating media of any type, except against air exchange. This object is attained by a venting device with the feature of claim 1 in its entirety.

In that, as specified in the characterizing part of claim 1, a labyrinth-like seal effectively seals the respective leakage point at least against penetrating media such as water and detergent chemicals, but not against air exchange for actual venting, by way of the system of seal passages within the labyrinth seal it is ensured that the respective penetrating medium, even in the form of dirt or dust, cannot pass the seal unintentionally in order to travel into the reservoir or tank interior to cause damage. The seal passages of the labyrinth seal ensure that the respective fluid or a particle-like penetrating medium is captured at one point of the labyrinth seal, with respect to the plurality of seal passages the labyrinth seal works redundantly, i.e., if for some reason a seal passage

should not ensure the desired sealing, the penetrating medium is then reliably stopped by a following seal passage.

In one preferred embodiment of the venting device as claimed in the invention, the labyrinth-like seal consists of the indicated system of seal passages, of which one part, in the manner of a collecting and delivery site, holds the respective penetrating medium. Without filling the other seal passages with the respective penetrating medium and in this way adversely affecting their effectiveness, accommodation of the respective penetrating medium by way of the respective central collecting and delivery site, which penetrating medium then centrally collected can also be removed again from the labyrinth seal by way of a delivery possibility, especially with incorporation of the force of gravity acting on the venting device. Reliable sealing without adversely affecting air exchange, i.e., the connection of the filter device to the ambient air, is thus effected.

In another preferred embodiment of the venting device as claimed in the invention, the respective collecting and delivery site is located in the bottom-side areas of the connecting part, their extending transversely or provided with a drain slant to the longitudinal axis of the venting axis. The bottom-side arrangement of the respective collecting and delivery site supports the force of gravity as the penetrating media are being collected and if the indicated sites are provided with drain slants or they extend at all transversely to the longitudinal axis of the venting device, the introduced media can be reliably and directly removed from the venting device by way of the delivery sites.

In one especially preferred embodiment of the venting device as claimed in the invention, the respective collecting and delivery site is part of a U-shaped or angled seal passage, at least in the

U-shaped seal passage the sealing legs of the fitted closure part engaging in the manner of a sealing cap. Fluid routing for the respective penetrating medium is achieved by way of the indicated sealing legs and moreover the direct penetration path into the interior of the venting device is blocked in the manner of a barrier or blockage.

In another preferred embodiment of the venting device as claimed in the invention, the sealing legs project from the seal flange of the closure part, the seal flange resting on both sides of the sealing leg on assignable sealing surfaces of the connecting part. In addition to blockage by way of the sealing leg, improved sealing also arises by way of the seal edges along the seal flange of the closure part.

In another especially preferred embodiment of the venting device as claimed in the invention, in the intended flow direction of the penetrating medium downstream of the U-shaped seal passage, an angularly positioned seal passage follows, the angular seal passages being present in a large number. By preference provision is made such that the respective angular seal passage is formed from the collecting and delivery site which is routed along the radial circumference of the connecting part and into which guide channels discharge which extends transversely to it and which with their other free end are connected to the U-shaped seal passage and to the interior of the venting device so as to be able to carry the media.

In this way, two seal systems (U-shaped and angular sealing areas) are obtained within one labyrinth seal, the flow passage for the respective penetrating medium proceeding essentially in planes parallel to the longitudinal axis of the venting device and a second sealing device is characterized in that its flow path for the penetrating medium runs essentially perpendicularly to the longitudinal axis of the venting device. Thus the planes of action of the first and second sealing

system of the labyrinth seal are essentially perpendicular to one another; this leads to major flow deflection for the respective penetrating medium and accordingly the penetration resistance for the penetrating medium is thus increased; this yields a labyrinth seal which can withstand high loads, with yet reliable sealing result.

In one especially preferred embodiment of the venting device as claimed in the invention, in the potential penetration direction of the respective medium downstream of the labyrinth seal there follows a filter element which as a portion of the closure part encompasses the air-carrying and fluid-carrying connection within the connecting part in the fitted state of the closure part. By way of the pertinent filter element the load on the system due to dirt and at the same time the dirt penetration rate can be noticeably reduced, even if by way of the penetrating medium this contamination should be introduced in the direction of the filter element into the tank venting device.

If preferably the closure part provided with wall-side catch parts together with a flange-like widened area of the valve part forms a catch connection in the manner of a quarter-turn fastener, by simple manual actuation the closure part can be detached from the connecting part in order for example to obtain information about the fill level of the reservoir (tank) by way of a gauge stick and if necessary to thus initiate a process of refilling with fluid.

The venting device as claimed in the invention will be explained in greater detail below with the aid of one embodiment as shown in the drawings, in which, in the form of diagrams and not drawn to scale

- FIG. 1 shows a perspective view of a longitudinal section through the venting device as claimed in the invention;

- FIG. 2 shows a longitudinal section according to FIG. 1 in a direct longitudinal view.

The venting device as shown in FIGS. 1 and 2 is intended especially for fluid-storing reservoirs such as tanks. The pertinent reservoir venting or tank venting is necessary if the overall fluid system requires air exchange to work. For connection to a reservoir such as a tank, a connecting part 10 is used which widens toward the top in cross section in the manner of a shoulder as shown in the figure and the connecting part 10 can for example be connected by way of an outside thread 12 to a screw-in section in the assigned tank (not shown), forming a seal. In the interior the connecting part 10 has an air-carrying and a fluid-carrying connection 14 which on its one lower end discharges into the reservoir or the volume of the tank. Furthermore, the connection 14 in its cross section likewise widens toward the top in correspondingly definable steps. If the connecting part 10 is connected by way of the screw-in section 12 to a reservoir like a tank, the venting device projects over the tank exterior on its top with a definable excess length.

Furthermore, the venting device, which will now be described in greater detail, is also suited for tank contents which have a definable charging pressure, for example around 0.5 bar or the like. On the top of the connecting part 10 there is a removable closure part 16 in the manner of a hood-like sealing cap which extends over the connecting part 10 on the outer circumferential side. In the area of the connection between the connecting part 10 and the closure part 16 there can be leakage points 18 (cf. FIG. 2), and the pertinent leakage points 19 can be sealed by way of a labyrinth seal which is designated as a whole as 20. In particular, it is possible by means of the labyrinth-like seal

20 to design the respective leakage point 19 to be effective in the manner of sealing at least against penetrating media such as water and/or detergent chemicals; this will be explained in greater detail below.

The labyrinth-like seal 20 consists of a system with a plurality of seal passages 22, of which some in the manner of a collecting and delivery site 24, 26 accommodate the respective penetrating medium. As FIG. 2 furthermore shows, the respective collection and delivery site 24, 26 is located in the bottom-side areas of the connecting part 10. In an embodiment which is not detailed, the pertinent bottom areas 28 can be provided with a drain slant in order to accelerate and facilitate the drainage of a liquid medium which may have penetrated. Furthermore, the bottom areas 28 can be provided with passages which extend through them, for example in the form of holes (not shown), in order to this make it possible to again discharge the penetrated medium by way of the passages in the connecting part 10 to the outside. The latter is especially indicated if for example by using a steam cleaning device under high pressure, a penetrating medium in the form of hot steam, also with the addition of detergent chemicals, is applied to the venting device in a large amount. A medium which is thus highly corrosive can then be for the most part retained by way of the labyrinth seal 20 and any medium which may penetrate is then reliably discharged again from the venting device by way of the collection and delivery sites 24, 26 with perforations (not shown). Depending on the application, it can also be sufficient to completely forego the pertinent passage sites in the bottom area 28 or for example to provide only the radially outermost bottom areas with a pertinent delivery capacity for the penetrating medium. Furthermore, it remains to be stated that the bottom-side areas 28 of the connecting part 10 and thus the collection and delivery sites 24, 26 are concentrically routed along annular surfaces around the longitudinal axis 30 of the venting device and extend transversely to the respective longitudinal axis 30.

As shown especially by FIG. 1, the respective collection and delivery site 24, 26 is part of a U-shaped seal passage 32 or of angular seal passages 34. In this respect, a radially circumferential sealing leg 36 of the closure part 16 fits into the groove-shaped recess 38 (cf. FIG. 2) and into the U-shaped seal passage 32 of the first part of the labyrinth seal 20. In addition to the radially projecting sealing leg 36, several sealing legs of the overall closure part 16 which are positioned in succession in a segmented manner could also form a first blockage in the direction of the potential penetration for the respective penetrating medium. The sealing leg 36 projects down proceeding from the seal flange 40, which projects as a lateral flange from the cap-like closure part 16 and in this way extends likewise transversely to the longitudinal axis 30 of the venting device. Extending on both sides of the seal flange 40 and separated by a sealing leg 36, which extends approximately in the center, it has two sealing surfaces 42, 44. With the outermost radial sealing surface 42, viewed in the direction of looking at FIG. 2, the seal flange 40 is in contact with the outermost wall part 46 which otherwise borders the groove-like recess 38 to the outside. The second sealing surface 44 in turn adjoins a vertically extending wall 48 which borders the recess groove 38 to the inside and which on its top has notches for the angular seal passages 34 of the second part of the labyrinth seal 20. The sealing surfaces between the sealing surface 42 and the wall part 46 and between the sealing surface 44 and the wall 48 thus lie essentially in one plane transversely to the longitudinal axis 30 of the venting device.

In the potential intended flow direction of the penetrating medium, downstream of the U-shaped seal passage 32, the angular seal passage 34 follows in a definable plurality, the pertinent seal passages 34 being specified especially in FIG. 1. The respective angular seal passage 34 is formed on the bottom side from the collection and delivery site 26 which is routed along the radial circumference of the connecting part 10, and into it guide channels 50 discharge which extend transversely thereto and which with their respective other free end are connected to the U-shaped

seal passage 32 and to the interior of the venting device so as to be able to carry media, in the form of a connection 14. As is to be seen from the longitudinal section from FIG. 1, a first deflection therefore takes place for the penetrating medium by way of the U-shaped seal passage 32 in planes essentially parallel to the longitudinal axis 30 of the device and the second, other seal in the form of angled seal passages 34 takes over fluid routing which runs essentially transversely thereto and transversely to the longitudinal axis 30. In the event that a drain slant should be provided for the second collection and delivery site 26, the slant can extend in the direction of the bottom area 28 with the first collection and delivery site 24 in order to convey the thus collected penetrating medium to the outside, especially if only the outermost collection and delivery site 24 were to have the corresponding delivery perforations (not shown).

In the potential penetration direction of the respective medium, downstream of the actual labyrinth seal 20, a filter element 52 of conventional design follows, so that at this point detailed reference is no longer made to the pertinent structure of the filter element. For purposes of filtration of the entering air flow, the filter element 52 nevertheless is part of the cap-like closure part 16 and radially encloses the air-carrying and fluid-carrying connection 14 within the connecting part 10, if the closure part 16 has been placed in its installation position as shown in the figures. For the pertinent connection, the closure part 16 is provided with edge-side catch parts 54 so that together with the flange-like widened area 56 of the connecting part 10 a catch connection in the manner of a quarter-turn fastener which can be detached by hand is formed. To facilitate the pertinent "screwing and unscrewing process", on the top of the closure part 16 a handle 58 can be used .

When the closure part 16 is removed from the connecting part 10, the filter element 52 which is integrated in the closure part 16 is at the same time removed from the connecting part 10, together with a valve and gauge stick device 60. In this way conclusions about the amount of fluid

which is still stored within the reservoir, such as a tank, can be drawn by way of the gauge stick. A corresponding refilling process with fluid (hydraulic medium) is then carried out as necessary by way of the connection 14 in the connecting part 10.

With the labyrinth seal 20 as a whole reliable sealing by way of the fluid and seal channels and passages is achieved in any case and even with high pressure cleaning treatment with hot steam, a corrosive penetrating medium (hot steam mixed with chemicals) can be precluded with certainty from unintentionally penetrating into the interior of the venting device and accordingly from coming into contact with the stored amount of fluid within the tank (not shown).